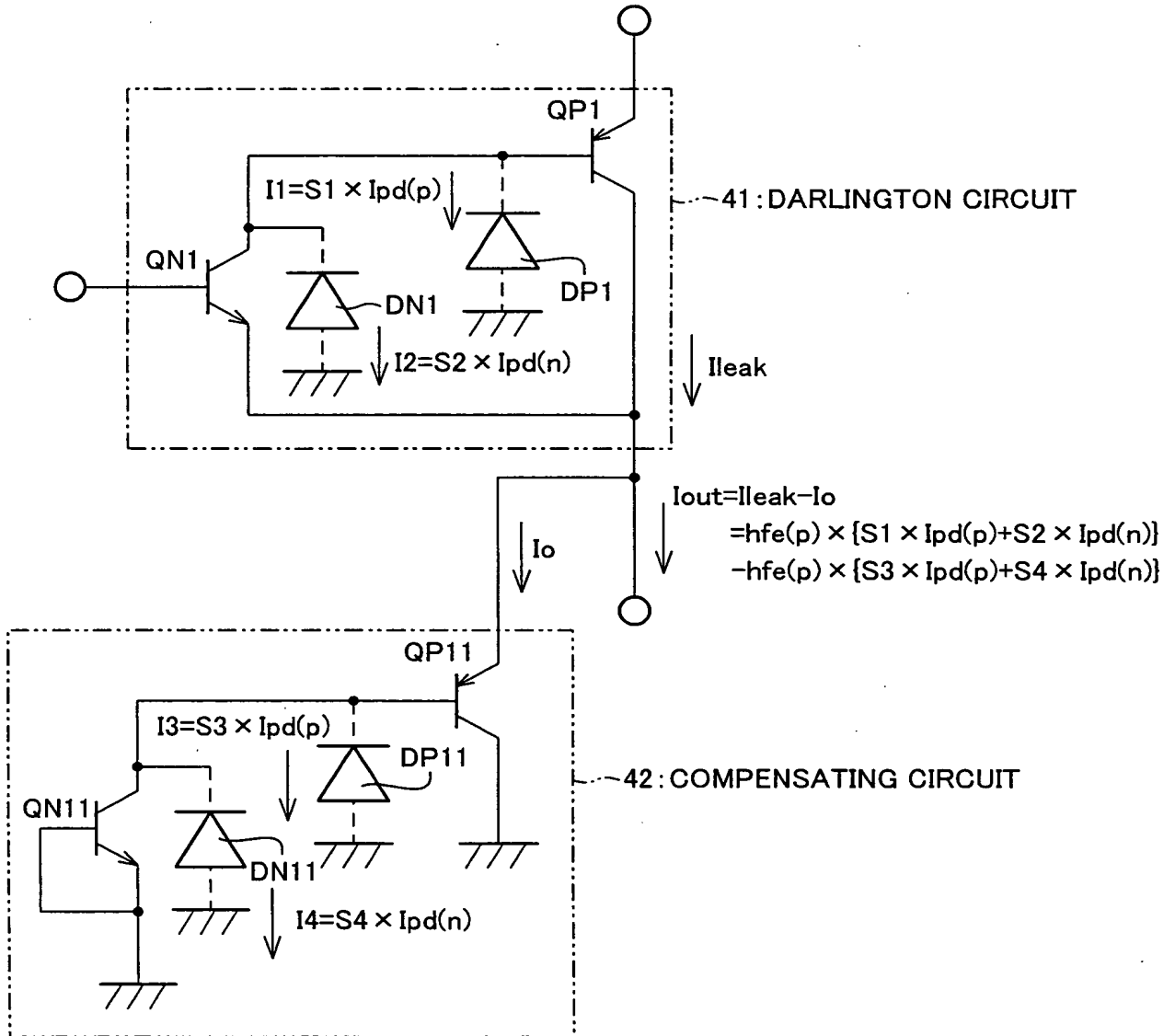


FIG. 1



**FIG. 2**  
RELATED ART

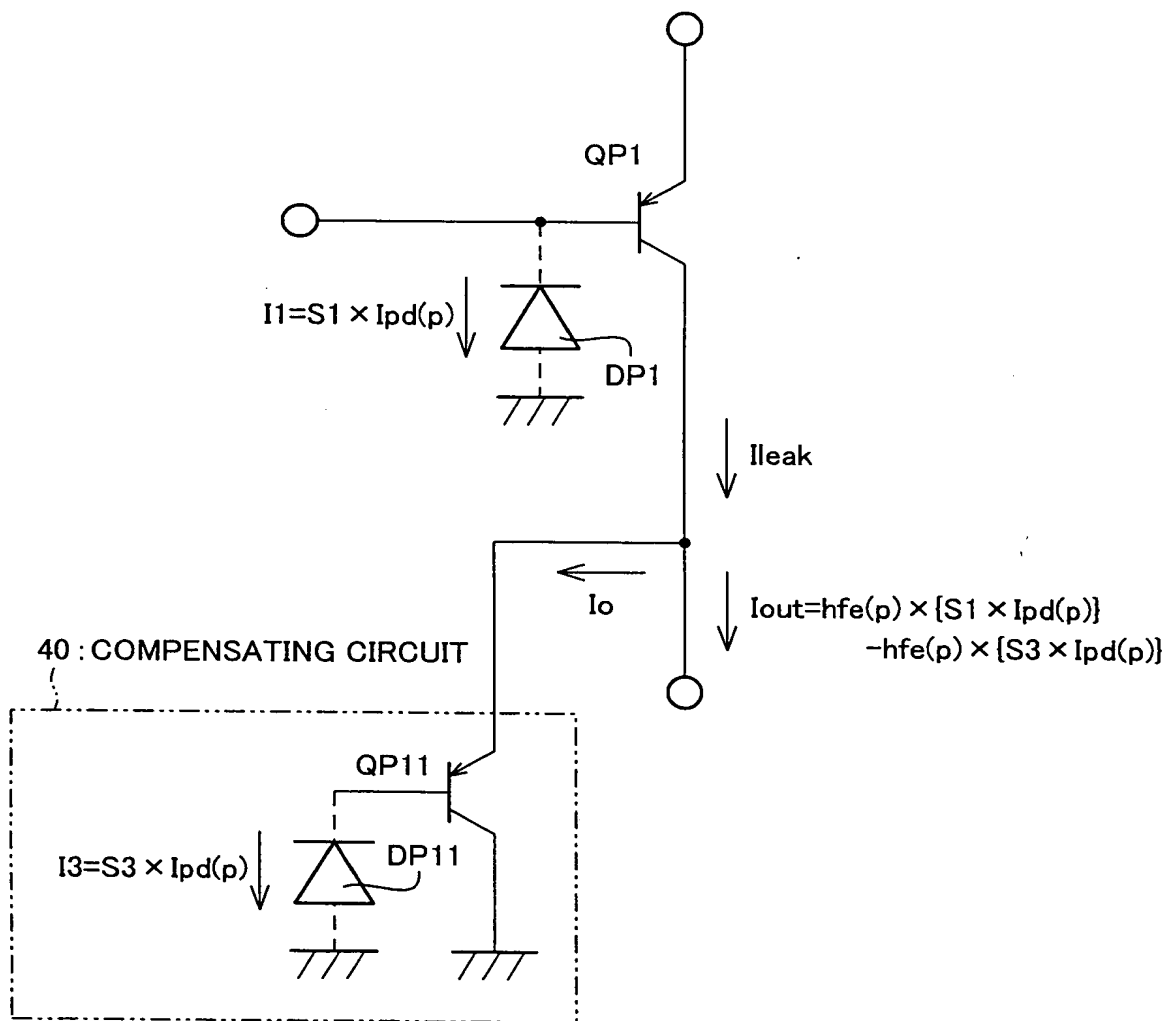


FIG. 3

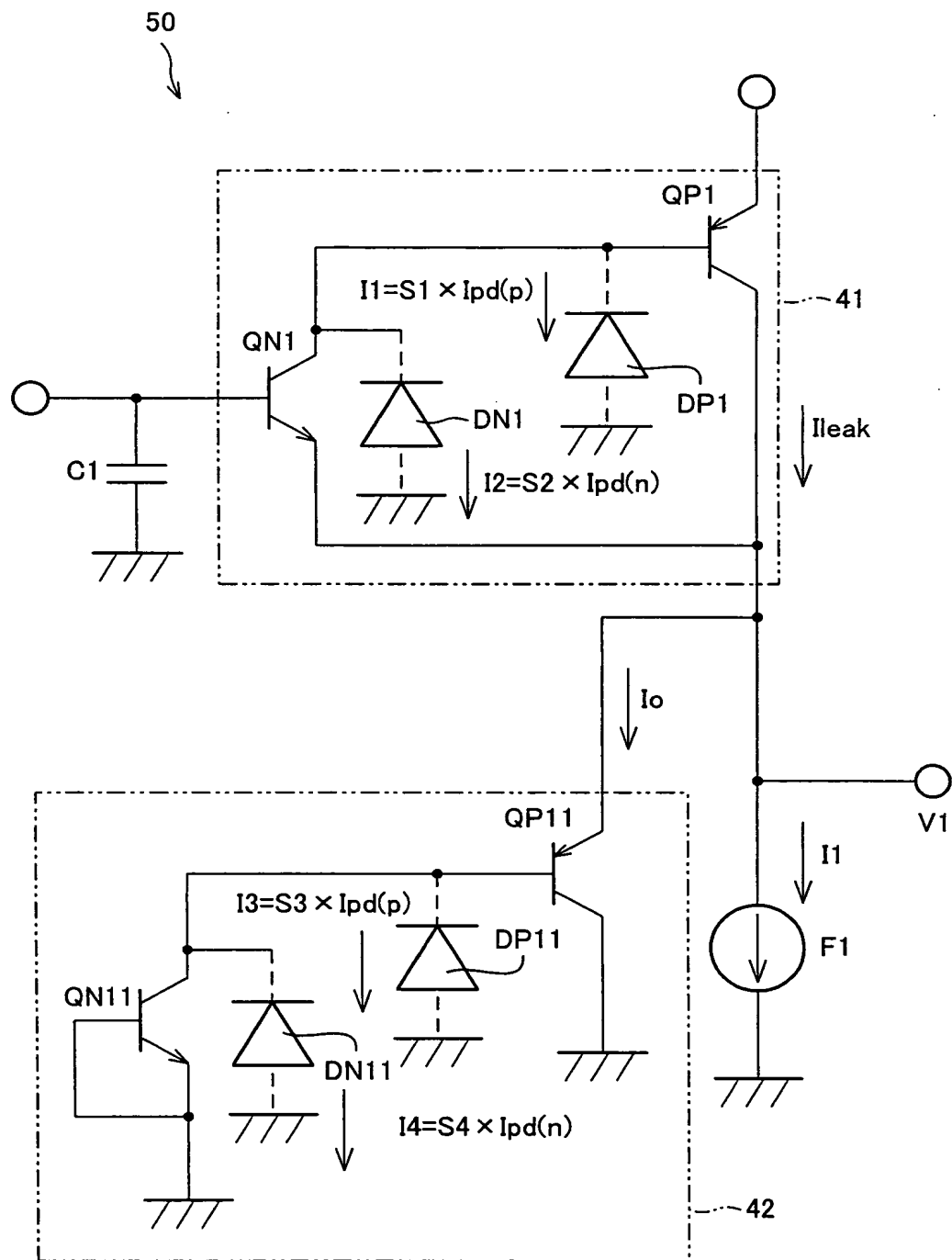
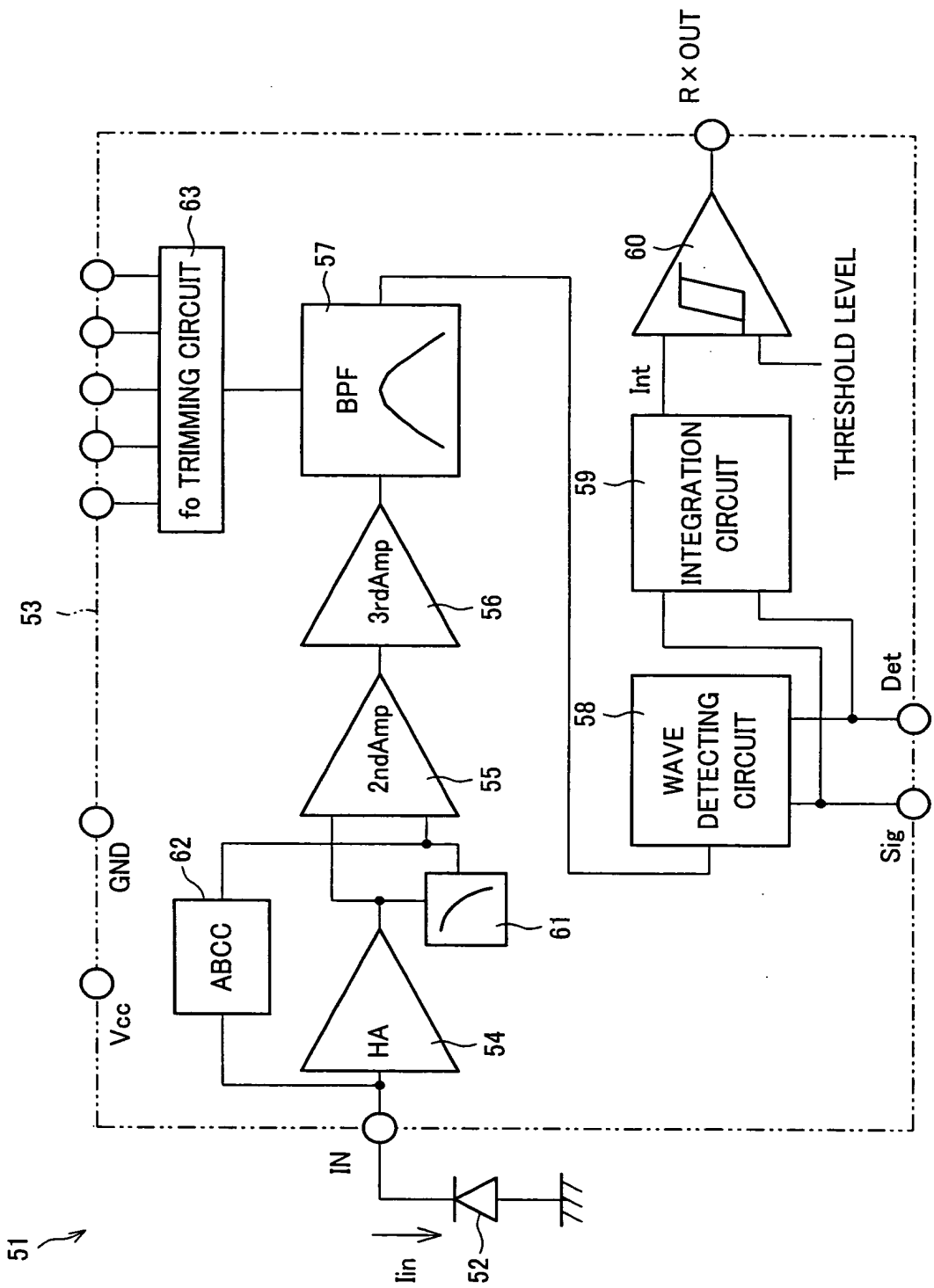


FIG. 4



The diagram illustrates a multi-stage current mirror circuit. It consists of two main blocks, 41 and 42, enclosed in dashed boxes.

**Block 41:** This block contains transistors QN1, QP1, QN2, and DP1. It also includes current sources DN1 and DP1. The current I1 is defined as  $I1 = S1 \times I_{pd}(p)$ , and the current I2 is defined as  $I2 = S2 \times I_{pd}(n)$ . A leakage current  $I_{leak}$  is shown flowing from the collector of QP1 to the emitter of QN2. The output current  $I_o$  is the difference between the collector current of QP1 and the collector current of QN2.

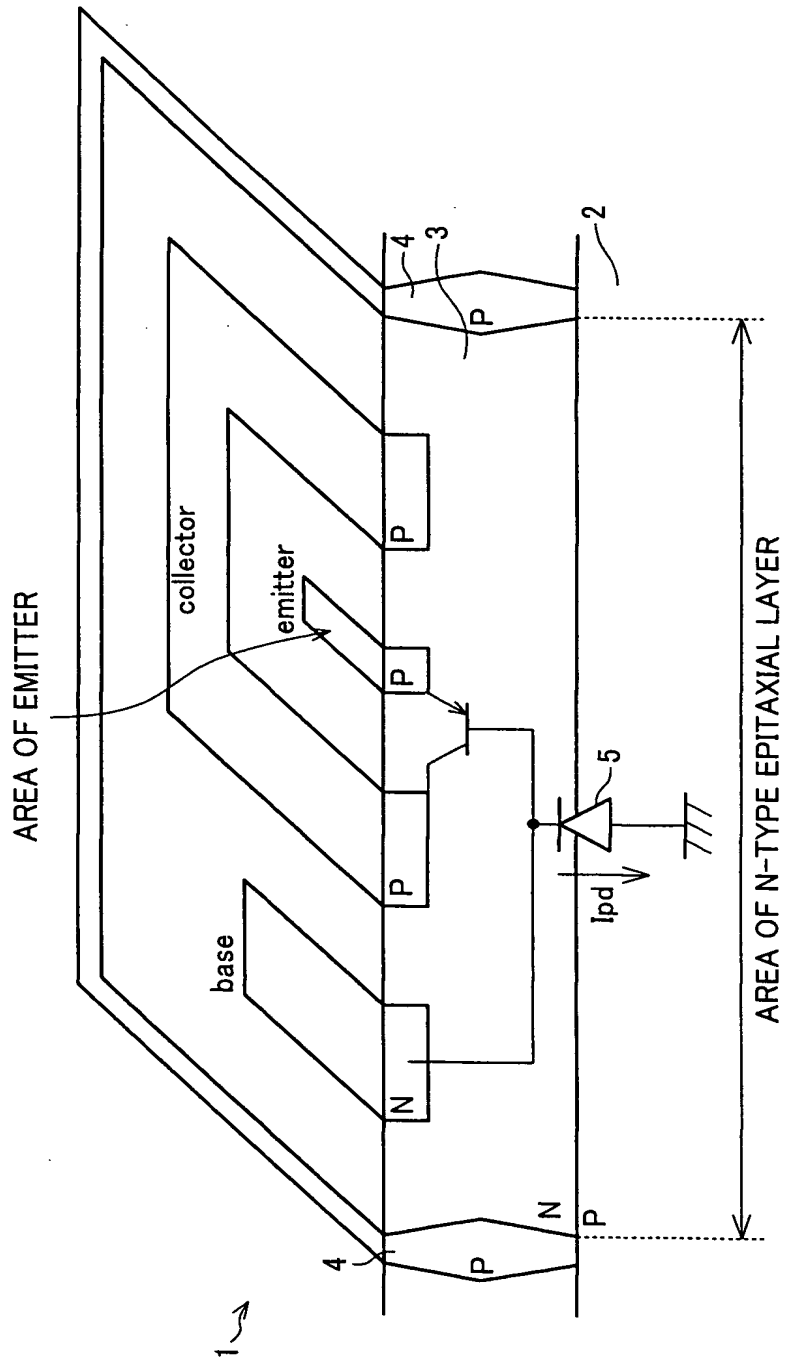
**Block 42:** This block contains transistors QN11 and QP11, and current sources DN11 and DP11. The current I3 is defined as  $I3 = S3 \times I_{pd}(p)$ , and the current I4 is defined as  $I4 = S4 \times I_{pd}(n)$ .

The overall output current  $I_{out}$  is given by the equation:

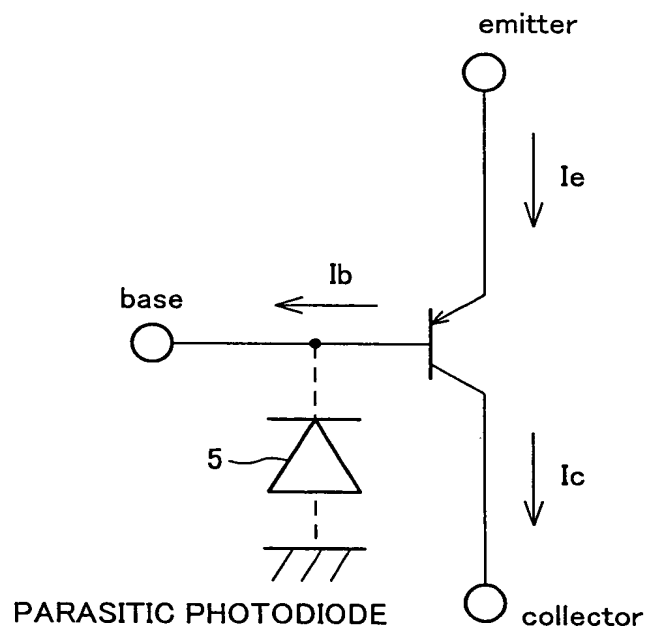
$$I_{out} = h_{fe}(n) \times [h_{fe}(p) \times \{S1 \times I_{pd}(p) + S2 \times I_{pd}(n)\} - h_{fe}(p) \times \{S3 \times I_{pd}(p) + S4 \times I_{pd}(n)\}]$$

$$I_{out} = hfe(n) \times [hfe(p) \times \{S1 \times I_{pd}(p) + S2 \times I_{pd}(n)\} - hfe(p) \times \{S3 \times I_{pd}(p) + S4 \times I_{pd}(n)\}]$$

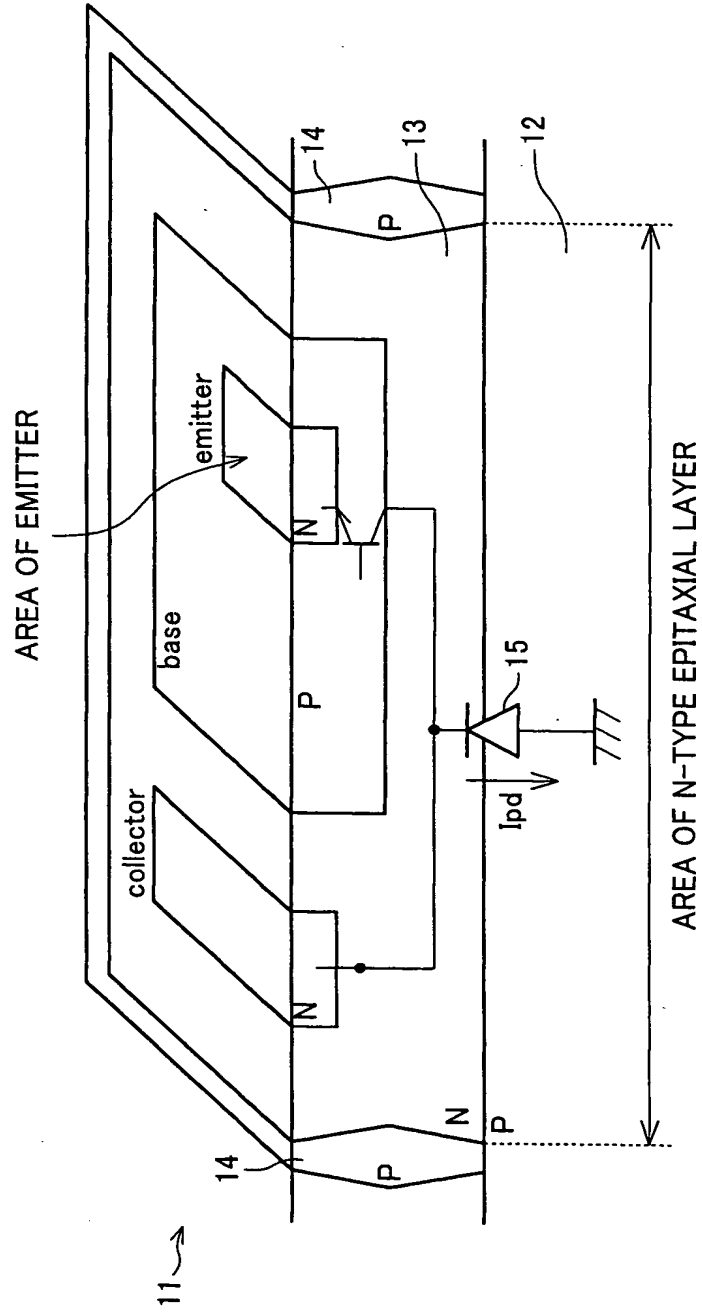
The diagram illustrates a semiconductor device structure, possibly a power MOSFET or IGBT, showing the emitter, base, collector, and various layers (1, 2, 3, 4, 5). The diagram includes labels for 'AREA OF EMITTER', 'AREA OF N-TYPE EPITAXIAL LAYER', and 'AREA OF P-TYPE EPITAXIAL LAYER'. It also shows a cross-section of the device with a p-n junction and a current flow arrow labeled  $I_{pd}$ .



**FIG. 7**  
PRIOR ART

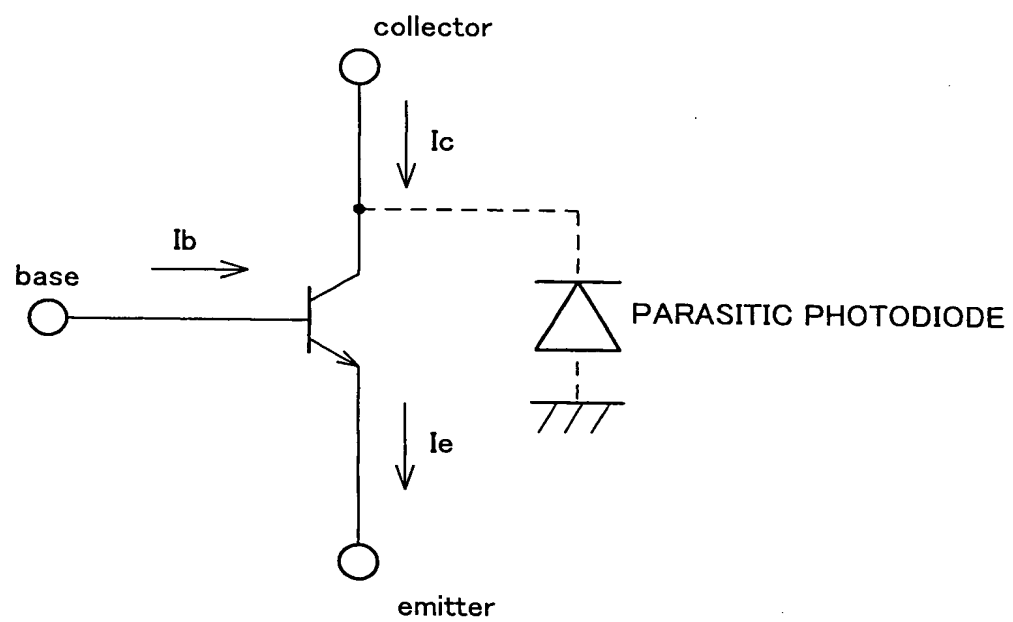


**FIG. 8**  
PRIOR ART



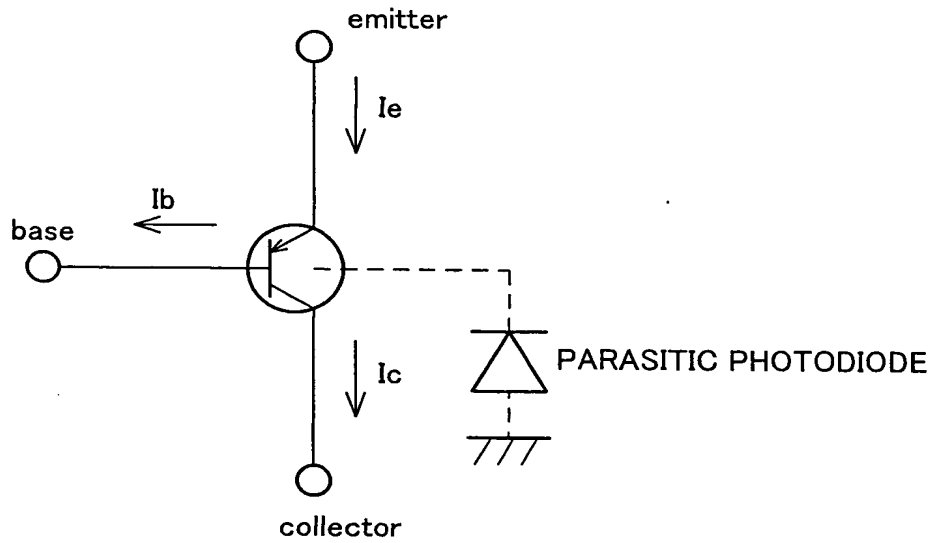


**FIG. 9**  
PRIOR ART

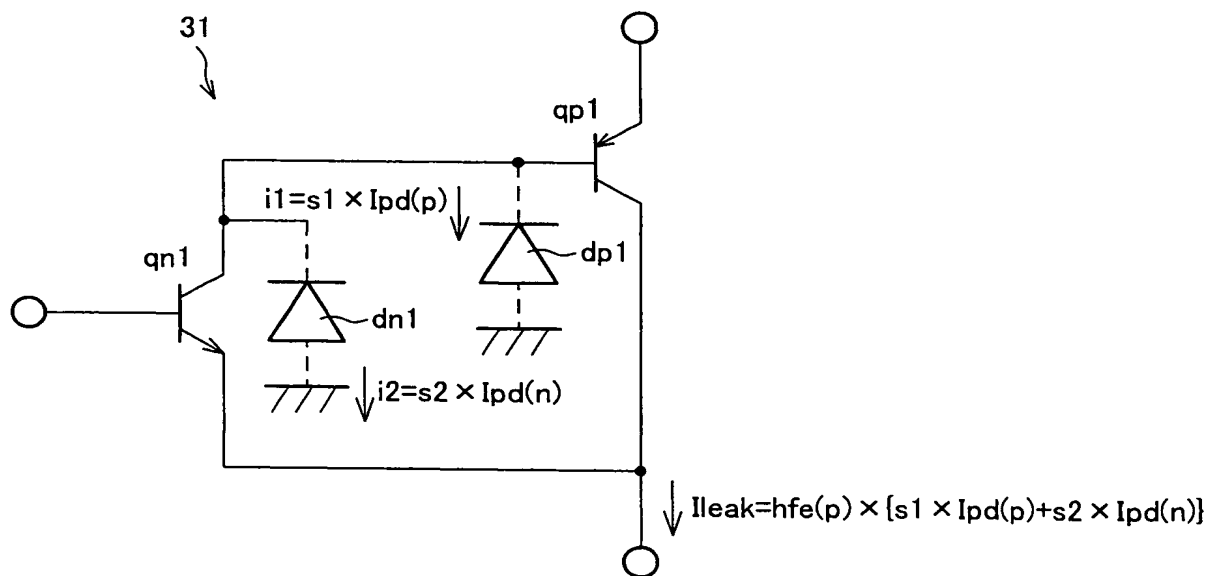




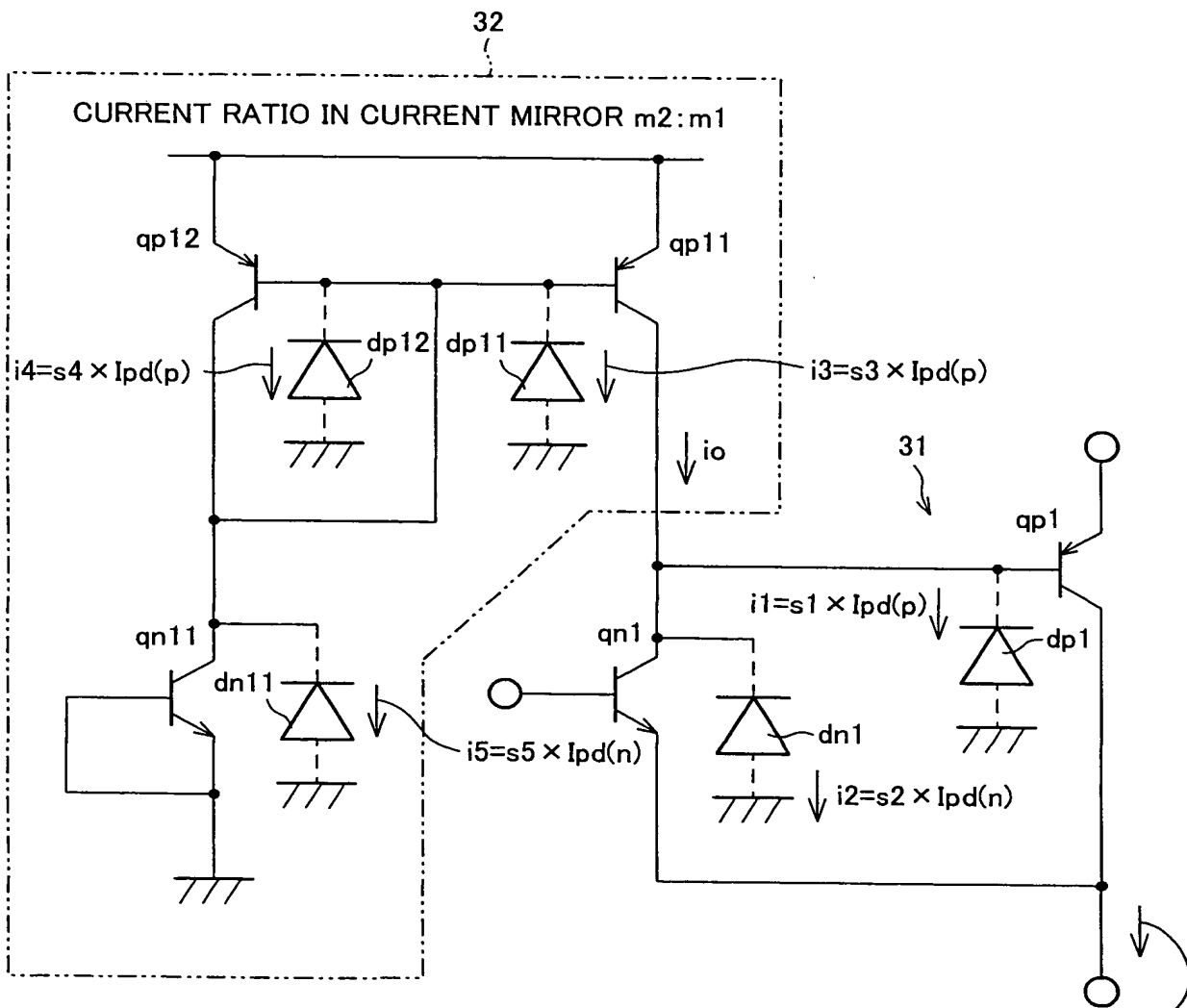
**FIG. 11**  
PRIOR ART



**FIG. 12**  
PRIOR ART



**FIG. 13**  
**PRIOR ART**



$$I_{leak} = h_{fe}(p) \times \{[s_1 \times I_{pd}(p) + s_2 \times I_{pd}(n)] - (m_1/m_2) \times [s_5 \times I_{pd}(n) + (s_3 + s_4) \times I_{pd}(p)]\}$$